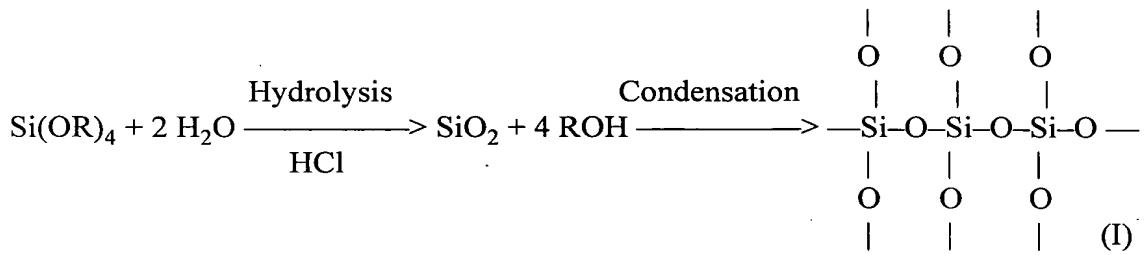


acrylsilane compounds, epoxysilane compounds, aminosilane compounds, γ -mercaptopropyltrimethoxysilane and γ -chloropropyltrimethoxysilane. On page 7, lines 2 to 22 of the present application, vinylsilane compounds, acrylsilane compounds, epoxysilane compounds, aminosilane compounds, γ -mercaptopropyltrimethoxysilane and γ -chloropropyltrimethoxysilane are listed as organic compounds exhibiting a molecular polarizability of 2×10^{-40} to $850 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$. On page 8, lines 17 to 22 of the present application, it is stated that a dispersion medium having a dielectric constant of 10 to 85 is preferred. Therefore, no new matter is introduced by this amendment.

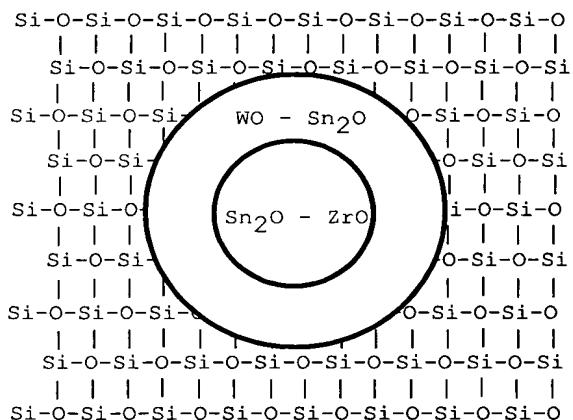
The Examiner rejected claim 1 under 35 U.S.C. § 103(a) as being obvious in view of U.S. Patent No. 5,366,545 to Yajima et al. Claim 1 and column 1, lines 45-52 of Yajima et al. refer to a coating composition including modified SnO_2 - ZrO_2 composite colloidal particles which are obtained by partially or fully coating the surface of SnO_2 - ZrO_2 composite colloidal particles with WO-SnO_2 composite colloidal particles, and an organosilicon compound. The Examiner maintains that the process of Yajima et al. produces SiO_2 composite particles corresponding to those of the present invention.

However, it is believed that this is not the case. According to examples provided by Yajima et al., an organosilicon compound is hydrolyzed and condensed in the presence of a catalyst (such as hydrochloric acid), and the resulting hydrolyzate of the organosilicon compound is mixed with a modified SnO_2 - ZrO_2 composite particle sol. The hydrolyzate of the organosilicon compound is a polysiloxane represented by the formula (I):

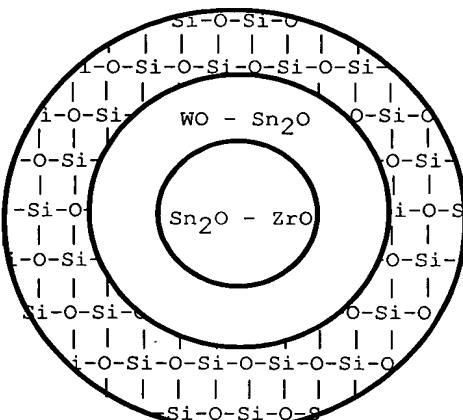


The resulting polysiloxane is a polymer having siloxane bonding. If such a polysiloxane is mixed with modified $\text{SnO}_2\text{-ZrO}_2$ composite colloidal particles, the resulting particles are the modified $\text{SnO}_2\text{-ZrO}_2$ composite colloidal particles dispersed in a polysiloxane matrix shown as (II) or coated by a polysiloxane shown as (III):

Dispersed in a polysiloxane (II)



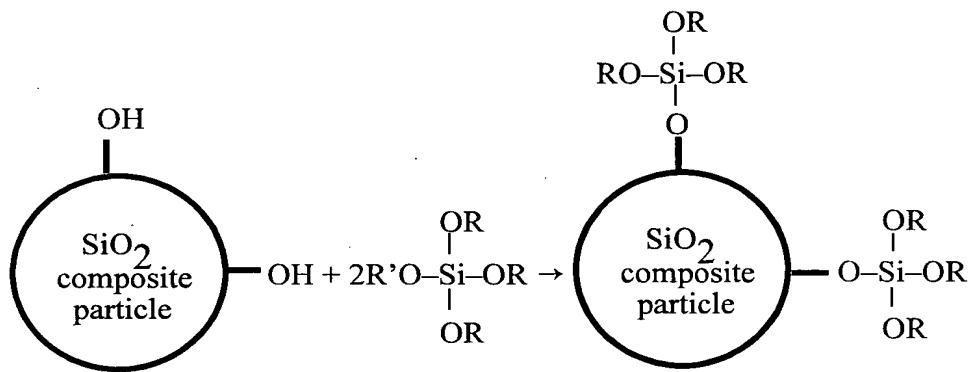
Coated by a polysiloxane (III)



According to the procedures taught by Yajima et al., the mixture of polysiloxane and modified SnO_2 - ZrO_2 composite colloidal particles does not result in SiO_2 composite particles. In contrast, SiO_2 composite particles used in the present invention

are modified by organosilane compounds exhibiting a molecular polarizability of 2×10^{-40} to $850 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$, selected from among vinylsilane compounds, acrylsilane compounds, epoxysilane compounds, aminosilane compounds, γ -mercaptopropyltrimethoxysilane and γ -chloropropyltrimethoxysilane.

In the present invention, modification by organosilane is caused by a condensation reaction of an -OH group on the surface of an SiO_2 composite particle:



This reaction is known and has been reported, for example in the "Silicone Handbook," Editor: Kunio Ito, Nikkan Kogyo Simbun, Ltd. (1990). This reaction of an organosilane compound with the -OH group of an SiO_2 composite particle surface differs significantly from the hydrolysis and condensation of organosilane particles themselves.

Yajima et al. teaches the use of an organosilicon compound or hydrolyzate thereof as a matrix or binder of a coating film. Therefore, the coating composition taught by Yajima et al. contains 1 to 500 parts by weight of the modified- SnO_2 - ZrO_2 composite particles based on 100 parts by weight of organosilicon

compound. (See column 5, lines 59 to 63.) The amount of organosilicon compound taught by Yajima et al. is 0.2 to 10,000 in terms of the weight ratio of the organosilicon compound to the modified $\text{SnO}_2 - \text{ZrO}_2$ composite particles.

In the present invention, in which the organosilane is used to modify the surface of SiO_2 composite particles, it is clear that the amount of organosilicon compound used is much less than the amount taught by Yajima et al. For example, the weight ratio of organosilicon compound to SiO_2 composite particles in the present invention is 0.14 in Example 1, 0.083 in Example 7, 0.15 in Example 9 and 0.068 in Example 13. These values are all less than the 0.2 minimum value taught by Yajima et al.

Yajima et al. teaches that the coating composition may contain hardening agents including silicic acid (H_4SiO_4) and SiO_2 . This supports the conclusion that silica (SiO_2) differs from composite oxide particles composed of silica and at least one organic oxide other than silica. Also, Yajima et al. does not teach the modification of silica particles by an organic compound selected from vinylsilane compounds, acrylsilane compounds, epoxysilane compounds, aminosilane compounds, γ -mercaptopropyltrimethoxysilane and γ -chloropropyltrimethoxysilane, exhibiting a molecular polarizability of 2×10^{-40} to $850 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$. For these reasons the coating composition of Yajima et al. is different from that of the present invention, and the effect of particulates of the present invention is not disclosed nor suggested by Yajima et al.

The Examiner rejected claim 1 under 35 U.S.C. § 103(a) as being obvious in view of U.S. Patent No. 5,593,781 to Nass et

al. The Examiner maintains that Nass et al. discloses checking or decreasing the agglomeration of nanosize particles by dispersing and surface treating and wholly or partly removing the dispersing agent, and that it is well-known to sterically stabilize silica. The Examiner also maintains that Nass et al. teaches that the ceramic nanosize particles may include silicates (mullite or cordierite) and that this reads on the composite oxides of silica and other inorganic oxides of the present application. The Examiner further maintains that Nass et al. teaches the use of numerous organic compound treating agents exhibiting a molecular polarizability including organo-alkoxysilanes related to those of the present application, and that the skilled artisan would have expected the treating agents taught in the Nass reference to have the claimed molecular polarizability.

Nass et al. refers to silicates such as mullite and cordierite which are composite oxides of silica and other inorganic oxides. Nass et al. teaches, as surface modifiers of nanosize particles of these substances, organo-alkoxysilanes represented by the general formula $R_{4-m}Si(OR')_m$, wherein the groups R and R' independently represent C1-C4 alkyl and m may be 1, 2, 3 or 4. However, the organo-alkoxysilanes taught by Nass et al. differ from the compounds of the present invention, selected from among vinylsilane compounds, acrylsilane compounds, epoxysilane compounds, aminosilane compounds, γ -mercaptopropyltrimethoxysilane and γ -chloropropyltrimethoxysilane, exhibiting a molecular polarizability of 2×10^{-40} to $850 \times 10^{-40} C^2 m^2 J^{-1}$. No compounds are described in Nass et al. as having such a molecular

polarizability, and the compounds taught by Nass et al. differ structurally from those of the present invention. The carbon numbers of the alkyl groups of the organo-alkoxysilanes taught by Nass et al. are very small (1 to 4); such organo-alkoxysilanes have molecular polarizabilities of less than $2 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$. For example, a molecular polarizability of $1.9 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$ for monomethylmonoalkoxysilane is shown in Comparative Example 2 of the present invention.

When the molecular polarizability of the organo-alkoxysilanes is lower than $2 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$, the organic properties of the organic compound are decreased so that the organo-alkoxysilanes have low affinity with the organic solvent. Therefore, the particles whose surfaces have been modified by such organo-alkoxysilanes have poor dispersibility in an organic solvent. In particular, when an acid, a base, a salt, or a surfactant thereof is present in the inorganic compound sol, the particulates are likely to aggregate with each other (See page 11, lines 11 to 17). Such an effect is clear from comparison of Example 1 with Comparative Example 2.

Table 1

	Sol Compo- sition	Modifying organic compound	Dispersion medium	Stability	
				Sulfuric Acid	Hydrochloric acid
Ex. 1	$\text{SiO}_2 \cdot \text{Al}_2\text{O}_3$	γ -glycidoxy- propyltrimeth- oxysilane	10.4×10^{-40}	Ethylene glycol	Stable at least 6 months
Comp. Ex. 2	$\text{SiO}_2 \cdot \text{Al}_2\text{O}_3$	Monomethyltri- methoxysilane	1.9×10^{-40}	Ethylene glycol	Gelled 30 days

As shown in Table 1, when the modifying organic compound has a molecular polarizability above $2 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$, the resulting organic compound sol has excellent dispersibility in organic solvent even if inorganic acids are present in the sol. (See Example 1.) In contrast, when the modifying organic compound has a molecular polarizability below $2 \times 10^{-40} \text{ C}^2\text{m}^2\text{J}^{-1}$, the resulting organic compound sol has poor dispersibility in organic solvent. (See Comparative Example 2.) For these reasons, the coating composition of Nass et al. differs from that of the present invention, and, therefore, the particulates of the present invention are neither disclosed nor suggested by Nass et al. Accordingly, it is believed that claim 1 is not obvious in light of Nass et al.

In view of the above, it is submitted that the claim is in condition for allowance. Reconsideration of the rejections is requested. Allowance of claim 1 at an early date is solicited.

Respectfully submitted,

WEBB ZIESENHEIM LOGSDON
ORKIN & HANSON, P.C.

By


Russell D. Orkin
Registration No. 25,363
Attorney for Applicants
700 Koppers Building
436 Seventh Avenue
Pittsburgh, PA 15219-1818
Telephone No. 412-471-8815
Facsimile No. 412-471-4094